Oxford Dendrochronology Laboratory
Report 2020/20

THE DENDROCHRONOLOGICAL DATING OF TIMBERS FROM 26 CHURCH STREET, HARWICH, ESSEX

(TM 25990 32652)

Summary

There are two distinct phases present – the front range (parallel to the street) has a smoke-blackened roof and dates to 1485, the rear range, perpendicular to the street, dates to 1576. The sixteenth-century timbers appear to be of relatively local origin (they match chronologies from Suffolk and Essex) but have many more rings than are commonly found in the area.

Author: Dr M. C. Bridge FSA
Oxford Dendrochronology Laboratory
Mill Farm
Mapledurham
Oxfordshire
RG4 7TX

August 2020

The Dendrochronological Dating of timbers from 26 Church Street, Harwich, Essex (TM 25990 32652)

BACKGROUND TO DENDROCHRONOLOGY

The basis of dendrochronological dating is that trees of the same species, growing at the same time, in similar habitats, produce similar ring-width patterns. These patterns of varying ring-widths are unique to the period of growth. Each tree naturally has its own pattern superimposed on the basic 'signal', resulting from genetic variations in the response to external stimuli, the changing competitive regime between trees, damage, disease, management etc.

In much of Britain the major influence on the growth of a species like oak is, however, the weather conditions experienced from season to season. By taking several contemporaneous samples from a building or other timber structure, it is often possible to cross-match the ring-width patterns, and by averaging the values for the sequences, maximise the common signal between trees. The resulting 'site chronology' may then be compared with existing 'master' or 'reference' chronologies. These include chronologies made by colleagues in other countries, most notably areas such as modern Poland, which have proved to be the source of many boards used in the construction of doors and chests, and for oil paintings before the widespread use of canvas.

This process can be done by a trained dendrochronologist using plots of the ring-widths and comparing them visually, which also serves as a check on measuring procedures. It is essentially a statistical process, and therefore requires sufficiently long sequences for one to be confident in the results. There is no defined minimum length of a tree-ring series that can be confidently cross-matched, but as a working hypothesis most dendrochronologists use series longer than at least fifty years.

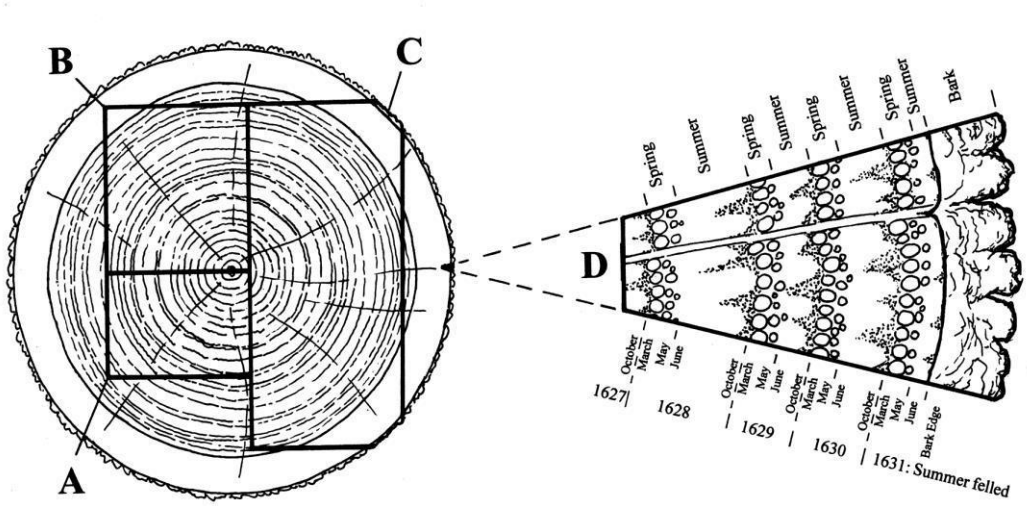
The dendrochronologist also uses objective statistical comparison techniques, these having the same constraints. The statistical comparison is based on programs by Baillie & Pilcher (1973, 1984) and uses the Student's *t*-test. The *t*-test compares the actual difference between two means in relation to the variation in the data, and is an established statistical technique for looking at the significance of matching between two datasets that has been adopted by dendrochronologists. The values of '*t*' which give an acceptable match have been the subject of some debate; originally values above 3.5 being regarded as acceptable (given at least 100 years of overlapping rings) but now 4.0 is often taken as the base value in oak studies. Higher values are usually found with matching pine sequences. It is possible for a random set of numbers to give an apparently acceptable statistical match against a single reference curve – although the visual analysis of plots of the two series usually shows the trained eye the reality of this match. When a series of ring-widths gives strong statistical matches in the same position against a number of independent chronologies the series becomes dated with an extremely high level of confidence.

One can develop long reference chronologies by cross-matching the innermost rings of modern timbers with the outermost rings of older timbers successively back in time, adding data from numerous sites. Data now exist covering many thousands of years and it is, in theory, possible to match a sequence of unknown date to this reference material.

It follows from what has been stated above that the chances of matching a single sequence are not as great as for matching a tree-ring series derived from many individuals, since the process of aggregating individual series will remove variation unique to an individual tree, and reinforce the common signal resulting from widespread influences such as the weather. However, a single sequence can be successfully dated, particularly if it has a long ring sequence.

Growth characteristics vary over space and time, trees in south-eastern England generally growing comparatively quickly and with less year-to-year variation than in many other regions (Bridge, 1988). This means that even comparatively large timbers in this region often exhibit few annual rings and are less useful for dating by this technique.

When interpreting the information derived from the dating exercise it is important to take into account such factors as the presence or absence of sapwood on the sample(s), which indicates the outer margins of the tree. Where no sapwood is present it may not be possible to determine how much wood has been removed, and one can therefore only give a date after which the original tree must have been felled. Where the bark is still present on the timber, the year, and even the time of year of felling can be determined. In the case of incomplete sapwood, one can estimate the number of rings likely to have been on the timber by relating it to populations of living and historical timbers to give a statistically valid range of years within which the tree was felled. For this region the estimate used is that 95% of oaks will have a sapwood ring number in the range 9 – 41 (Miles 1997).



Section of tree with conversion methods showing three types of sapwood retention resulting in **A** *terminus post quem*, **B** a felling date range, and **C** a precise felling date. Enlarged area **D** shows the outermost rings of the sapwood with growing seasons (Miles 1997, 42)

<u>26 Church Street</u> (from the Listing, list entry number 1187883, and observations by Brenda and Elphin Watkin)

One half of the frontage range is one bay of a long wall jetty house of late C15th or early C16th. One flank truss is closed but with former central door, or more likely a window, opening on the first floor. The other flank was 'open' with arch braces to tie beams. Roof was of crown post type surviving in part. To rear, at right-angles, is late C16th two-storey timber frame and 3 bays, formerly jettied at W end with framed bressumer of one large quadrant moulding, but with the ground floor wall missing. INTERIOR: the W bay formed one small chamber on each floor and upper has curious internal wall bracing, curving up from wall posts and then down to stop at a stud. 'Tye' beams are tenoned into the top plates, for construction of the former jettied gable. These timbers are substantially contemporary roof with simple collar rafter couples. One frieze window of 3 lights survives on flank wall of larger first-floor chamber.

The long axis of the house lies NE-SW, but for the purposes of this report, to make descriptions easier, it is taken as W-E.

SAMPLING

Sampling took place in August 2020, following an assessment of several buildings in Harwich the previous year. The samples were labelled (prefix **hchs**) and returned to the Lab, were they were polished with progressively finer grits down to 400 to allow the measurement of ring-widths to the nearest 0.01 mm. The samples were measured under a binocular microscope on a purpose-built moving stage with a linear transducer, attached to a desktop computer. Measurements and subsequent analysis were carried out using DENDRO for WINDOWS, written by Ian Tyers (Tyers 2004). Other programs written by Chris Bridge (RingMaster) were used for dating.

RESULTS AND DISCUSSION

The rear section, perpendicular to the street, was sampled first. This phase has unusual wall bracing (see photo and Fig 1) and a jetty at the rear with a quadrant moulded bressumer (now internal as there is a later extension). The timbers are unusual for this area in that they are relatively slow-grown, and contain many rings. Six samples were taken, and cross-matched (Table 2a). This revealed the very strong matches between the wallplates, which were subsequently assumed to have each been converted from the same parent tree. A new sequence (hchs654) was made for subsequent analysis. The long sequences matched together well, and appear to form a coherent group, giving a site master chronology of four trees (six timbers), containing 190 years. This long site chronology (HCHSt4) gave very good matches against the reference database, establishing its date range as 1386-1575 (the strongest matches being shown in Table 3b). One tree was found to have been felled in winter 1575/6, one in summer 1576, one had detached sapwood and gives a narrow likely felling date range of 1574–9, and the last tree is represented by a timber that retained only one sapwood ring, but gives a likely felling date range consistent with the others. It seems most likely therefore that the construction of this rear phase took place in 1576, or within a year or two after this date. The matches are strongest with timbers from Suffolk and Essex, suggesting that they are of local origin, although they are unusual in having so many rings.

The front range roof with smoke-blackened timbers was made of much faster grown timbers, having many fewer rings. Four timbers were sampled, but one series had only 29 rings, and could not be matched against the others with certainty. The remaining three series matched each other (Table 2b) and these were combined to form a second site chronology (**hchs1097**) of just 55 rings. It was thought that the chances of dating these short timbers might be marginal, but in fact the chronology dated very readily to the period 1430–1484, the strongest matches being shown in Table 3a. Two of the timbers were found to be from trees felled in the sequential winters of 1483/4 and 1484/5, with the third tree having a likely felling date range encompassing these dates. Construction seems most likely in 1485, or within a year or two after this date. The trees used are less clearly of local origin, although this seems most likely.

The relative matching of the timbers is shown, along with their felling dates, in Figure 2.

These dates confirm the previous dating based on stylistic evidence, but give more precision, which may help subsequently in tracking down any records associated with the building and its residents.

ACKNOWLEDGEMENTS

This study was commissioned by The Harwich Society, funded through an HLF grant. Richard Oxborrow made all the arrangements, and I am grateful to the owners, Mr and Mrs Robinson for their

enthusiastic support. I thank my fellow dendrochronologists for permission to use their data.

REFERENCES

Arnold, A. J., Howard, R E, and Litton, C. D. (2003a) *Tree-ring analysis of timbers from Stonepitts Manor, Seal, Kent*, **Centre for Archaeology Rep**, 39/2003.

Arnold, A. J., Howard, R. E., Laxton, R. R. and Litton, C. D. (2003b) *Tree-ring analysis of timbers from Cobham Hall, Cobham, Kent*, **Centre for Archaeology Rep**, 50/2003.

Arnold, A., Howard, R., Hurford, M. and Tyers, C. (2008) *Flore's, Oakham, Rutland, Tree-ring analysis of the timbers*, **EH Res Dept Rep Ser**, 94/2008.

Arnold, A. and Howard, R. (2009) *Westenhanger Manor Barn, Stone Street, Stanford, Kent: tree-ring analysis of the timbers*, **EH Res Dept Rep Ser**, 37/2009.

Arnold, A. J. and Howard, R. E. (2015) *The Abbot's Lodging and Corridor, Coggeshall Abbey, Essex: tree-ring analysis of timbers*, **HE Res Rep Ser**, 27/2015.

Baillie, M.G.L. and Pilcher, J.R. (1973) *A simple cross-dating program for tree-ring research*. **Tree Ring Bulletin**, 33, 7-14.

Bridge, M. C. (1988) *The dendrochronological dating of buildings in southern England*, **Medieval Archaeology**, 32, 166-174.

Bridge, M. C. (1999) *Tree ring analysis of timbers from Hill Hall, Theydon Mount, Essex*, **Anc Mon Lab Rep**, 55/1999.

Bridge, M. C. (2001) *Tree-ring analysis of timbers from Odda's Chapel, Deerhurst, Gloucestershire*, **Centre for Archaeology Report**, 114/2001.

Bridge, M. C. (2003) List 134 **Vernacular Architecture** 34, 91-95.

Bridge, M. C. (2004) *Tree-ring analysis of timbers from the bellframe, Church of St Mary, Church Street, Attelborough, Norfolk*, **Centre for Archaeology Rep**, 5/2004.

Bridge, M. C. and Dobbs, C. (1996) *Tree-ring studies on the Tudor warship Mary Rose*, in **Tree Rings, Environment and Humanity** (eds J S Dean, D M Meko, and T W Swetnam), 491-496, Arizona.

Bridge, M. C. and Miles, D. (2016) Tree-Ring Date Lists, **Vernacular Architecture**, 47, 87-92.

English Heritage (1998) *Guidelines on producing and interpreting dendrochronological dates*, **English Heritage, London.**

Hillam, J. and Groves, C. (1996) *Tree-Ring Research at Windsor Castle: Aims and Initial Results*, in **Tree Rings, Environment and Humanity**, (eds J S Dean, D M Meko, and J W Swetnam), 515-23, Arizona Univ.

Howard, R. E., Laxton, R. R. and Litton, C. D. (2000) *Tree-ring analysis of timbers from Church House, Edenbridge, Kent*, **Anc Mon Lab Rep**, 34/2000.

Miles, D. (1997) *The interpretation, presentation, and use of tree-ring dates*, **Vernacular Architecture**, 28, 40-56.

Miles, D. H. and Worthington, M. J. (2002) Tree-ring dates, **Vernacular Architecture**, 33, 81-102.

Miles, D. H., Worthington, M. J. and Bridge, M. C. (2007) Tree-ring dates, **Vernacular Architecture**, 38, 120-139.

Miles, D. H. and Bridge, M. C. (2010) Tree-ring dates, **Vernacular Architecture**, 41, 102-105.

Miles, D. H. and Bridge, M. C. (2013) Tree-ring Dates, **Vernacular Architecture**, 44, 98-102.

Miles, D. H. and Bridge, M. C. (2014) Tree-ring Dates, **Vernacular Architecture**, 45, 115-119.

Tyers, I. (2004) *Dendro for Windows Program Guide 3rd edn*, **ARCUS Report,** 500b**.**

Tyers, I, and Boswijk, G, (1998) *Tree-ring analysis of oak timbers of the Church of St Mary Magdalen, Magdalen Laver, Essex*, **Anc Mon Lab Rep**, 23/98.

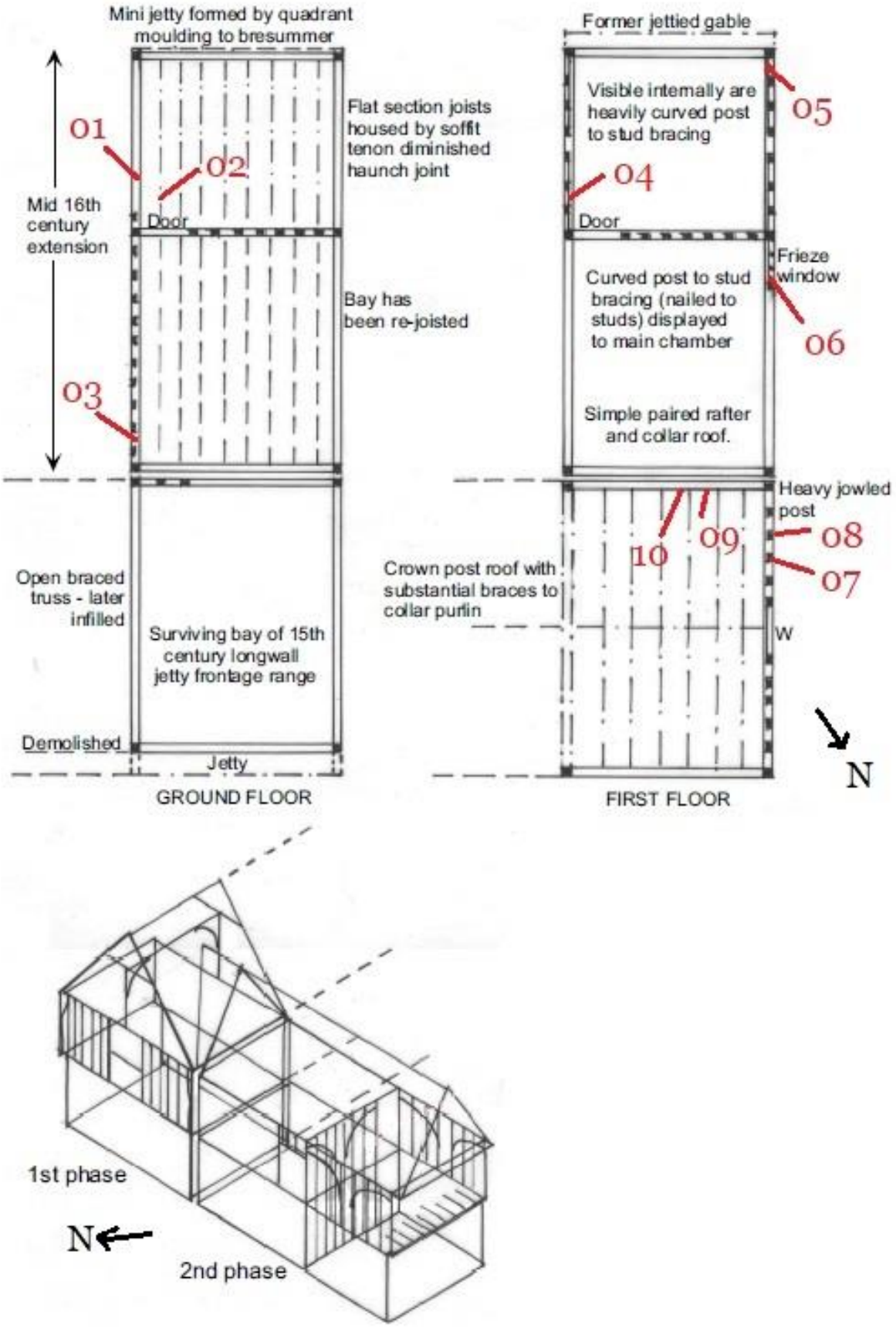


Figure 1: Drawings showing the approximate locations of samples taken for dendrochronology, adapted from an original by Brenda and Elphin Watkin

Table 1: Details of samples taken from 26 Church Street, Harwich (axis taken as east-west)

Sample number	Timber and position	Date of series	h/s boundary date	Sapwood complement	No of rings	Mean width (mm)	Mean sens	Felling date range (AD)
Rear range								
***hchs01**	Rear bay, mid-rail on south side	1413–1575	1571	24½C	163	1.01	0.31	summer 1576
***hchs02**	2nd joist from south wall	1496–1561	1560	1	66	1.57	0.30	1569–1601
***hchs03**	Mid-rail south, middle bay	1432–1540	1539	1 +*c*34NMC	109	0.88	0.20	1574–*c*79
hchs04	South wallplate, rear bay	1398–1575	1529	46C	178	1.09	0.25	winter 1575/6
hchs05	North wallplate, rear bay	1428–1561	1545	16 +5NM	134	1.48	0.26	*ditto*
hchs06	North wallplate, middle bay (over frieze window)	1386–1561	1537	24	176	1.07	0.21	*ditto*
***hchs654**	Mean of **04**, **05** and **06** (same tree)	1386–1575			190	1.25	0.22	winter 1575/6
* = component of **HCHSt4**		**1386–1575**			***190***	***1.23***	***0.22***	
Front range roof								
† hchs07	4th stud from west in north gable wall	1440–1478	1465	13	39	2.64	0.23	1466–1506
hchs08	2nd stud from west in north gable wall	undated	-	6	29	3.74	0.17	-
† hchs09	West slope, 4th rafter from north	1430–1483	1467	16C	54	1.69	0.19	winter 1483/4
† hchs10	West slope, 5th rafter from north	1434–1484	1467	17C	51	1.89	0.15	winter 1484/5
† = component of **hchs1097**		**1430–1484**			***55***	***2.01***	***0.17***	

Key: h/s bdry = heartwood/sapwood boundary; ¼C = complete sapwood, felled the following spring; C = complete sapwood, felled the following winter; mean sens = mean sensitivity; NM = not measured.

Table 2a: Cross-matching between the individual components of **HCHSt4** (shaded cells indicate same tree)

t-value					
Sample No	**hchs02**	**hchs03**	**hchs04**	**hchs05**	**hchs06**
hchs01	8.0	7.3	6.4	5.0	7.6
hchs02		3.0	6.0	6.8	6.4
hchs03			6.5	6.4	6.8
hchs04				15.1	15.8
hchs05					16.8

Table 2b: Cross-matching between the individual components of **HCHS1097**

t-value		
Sample No	**hchs09**	**hchs10**
hchs07	5.4	5.3
hchs09		5.5

Table 3a: Dating evidence for the site series **hchs1097 1430–1484** against dated reference chronologies

County or region:	*Chronology name:*	*Reference*	*File name:*	*Spanning*	*Overlap (yrs)*	*t-value*
Site/Regional Chronologies						
Hampshire	Mary Rose 'original' timbers	(Bridge and Dobbs 1996)	ORIGINAL	1334–1503	55	7.2
London	Buttery Roof, Hampton Court	(Miles and Bridge 2013)	HMPTNCT4	1340–1516	55	6.9
Essex	Old Priory, Newport	(Miles and Bridge 2014)	NEWPTOPR	1441–1496	44	6.7
Essex	Moreton Church	(Bridge 2003)	MORETON2	1425–1501	55	6.7
Kent	Church House, Edenbridge	(Howard *et al* 2000)	EDBASQ01	1377–1538	55	6.6
Gloucestershire	Odda's Chapel, Deerhurst	(Bridge 2001)	ODDA	1352–1593	55	6.2
Essex	Magdalen Laver	(Tyers and Boswijk 1998)	MLAVER	1411–1534	55	6.0
Kent	Stonepitts Manor, Seal	(Arnold *et al* 2003a)	KSMASQ01	1389–1497	55	5.9
Rutland	Flore's, Oakham	(Arnold *et al* 2008)	OKMASQ01	1173–1392	55	5.8
Kent	Westenhanger Manor Barn	(Arnold and Howard 2009)	WHBASQ02	1323–1489	55	5.8
Norfolk	Attleborough bellframe	(Bridge 2004)	ATTLBRGH	1418–1514	55	5.7

Table 3b: Dating evidence for the site series **HCHSt4 1386–1575** against dated reference chronologies

County or region:	*Chronology name:*	*Reference*	*File name:*	*Spanning*	*Overlap (yrs)*	*t-value*
Site/Regional Chronologies						
Suffolk	Crow's Hall	(Miles *et al* 2007)	CROWSHL1	1406–1559	154	10.6
Kent	Cobham Hall	(Arnold *et al* 2003b)	COBHSQ01	1317–1662	190	9.1
Essex	Coggeshall Abbey	(Arnold and Howard 2015)	COGASQ02	1372–1567	182	8.6
Kent	Knole	(Miles and Bridge 2010)	KNOLE1	1431–1605	145	8.5
Essex	Hill Hall, Theydon Mount	(Bridge 1999)	HILLHAL1	1425–1564	140	8.4
Essex	55-63 Stoneham St., Coggeshall	(Miles and Bridge 2013)	COGGS1	1338–1554	169	8.3
Berkshire	Hayley Green Farm, Warfield	(Miles and Worthington 2002)	HAYLYGRN	1338–1567	182	8.1
London	Queen's House, Tower of London	(Bridge and Miles 2016)	TOLQHS1	1353–1538	153	7.9
Berkshire	Windsor Castle kitchen	(Hillam and Groves 1996)	WC KITCH	1331–1573	188	7.8
Suffolk	Bedfield Hall	(Miles *et al* 2007)	BEDFLD2	1473–1627	103	7.8
Suffolk	Nettlestead Chace	(Miles *et al* 2007)	NETTLE1	1466–1562	87	7.7

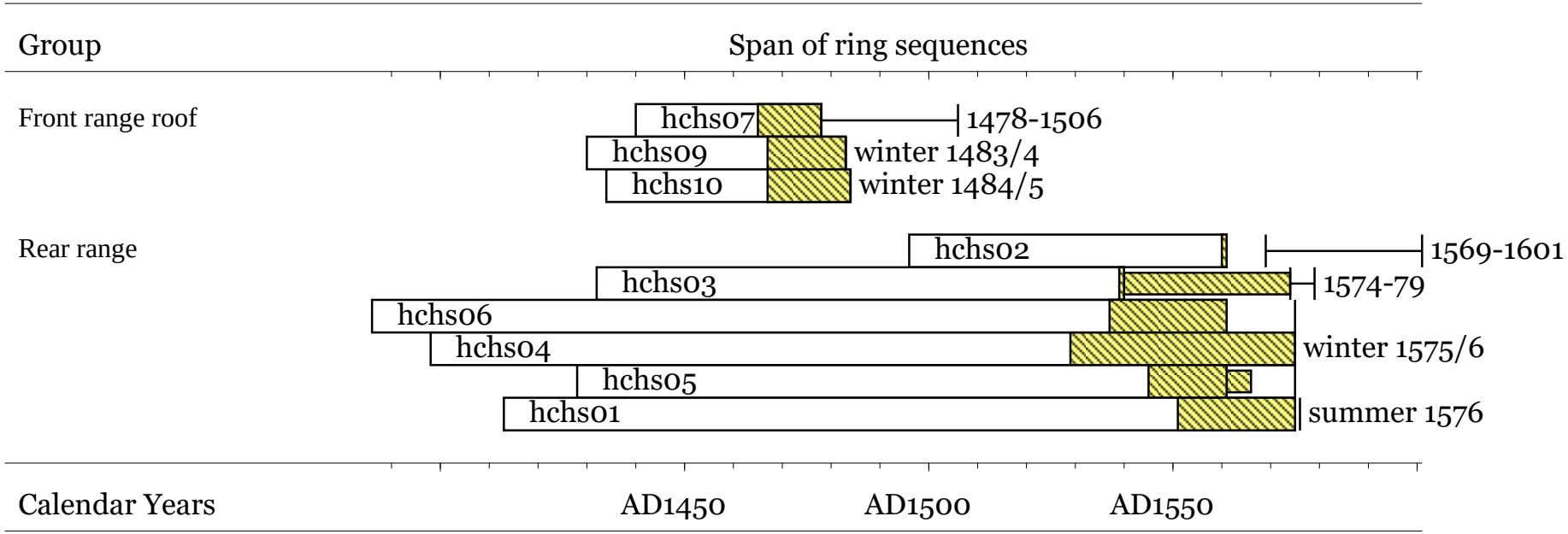


Figure 2: Bar diagram showing the relative positions of overlap of the dated sequences, along with their likely felling date ranges, white bars represent oak heartwood, yellow hatched bars – sapwood, narrow bar – additional unmeasured rings